

MICROBIOLOGY

Immobile bacteria hitchhike on rafts

Bacteria that are unable to move on their own can hitch a lift on their mobile neighbours.

Yael Helman of the Hebrew University of Jerusalem and her team found that, on agar plates, the bacterium *Xanthomonas perforans* — which does not move on solid surfaces — triggered *Paenibacillus vortex* to move closer to it, and then used this travelling species as transport. This interaction occurred even when the two species were separated by a plastic barrier, suggesting that *X. perforans* releases an airborne substance to signal for a lift. Electron-microscope images revealed single *X. perforans* cells on 'rafts' of *P. vortex*.

This hitchhiking also occurred on leaves, and between other xanthomonads and motile bacteria, suggesting that the behaviour could be widespread.

ISME J. <http://doi.org/q67> (2013)

GEOLOGY

Water dives deep inside Earth

Slabs of Earth's crust that are plunging deep into the planet could be carrying much larger amounts of water into the planet's mantle than previously thought.

In the northwest Pacific Ocean, where the Pacific plate sinks beneath Japan, Tom Garth and Andreas Rietbrock of the University of Liverpool, UK, studied earthquakes originating from within the diving slab. Modelling indicated that the quakes occur along water-rich faults that form as the plate bends before diving below.

Over Earth's lifetime, the



PALAEANTHROPOLOGY

Broken teeth point to rough diet

Teeth from a 1.8-million-year-old human fossil show signs of disease and are extremely worn — possibly from eating hard and fibrous foods.

In 2000, researchers uncovered a jaw bone (pictured) at a site in Dmanisi, Georgia, which has produced the oldest human fossils outside Africa. Laura Martín-Francés at the National Research Centre on Human Evolution in Burgos, Spain, and her team examined the fossil, dubbed

D2600, including its teeth. Most of the teeth had no protective enamel left, and the roots and interior showed signs of infection.

The wear patterns — which are unlike those of other human specimens of a similar age — could have been caused by a diet of abrasive and fibrous plants and fruits, similar to that of apes, the researchers say.

Comptes Rendus Palevol <http://doi.org/q5t> (2014)

Pacific plate could have taken the equivalent of 3.5 oceans into the mantle. Some of that water is released and rises upward, fuelling volcanoes; the rest plunges deeper into the planet.

Geology <http://doi.org/q7p> (2014)

ATMOSPHERIC SCIENCE

Shifting winds freeze China

Not only has climate change been responsible for frequent bouts of record-breaking summer heat in China since 2000, but it could also be the cause of the unprecedented winter cold that has plagued northern parts of the country

in several recent years.

Xueyuan Kuang and her team at Nanjing University in China analysed the distribution of record-breaking high and low temperatures observed between 1951 and 2010 at nearly 1,900 weather stations across China. Records for summer highs were set more frequently between 2000 and 2010 than in the previous two decades. Record winter lows seemed to cluster in northern China in the 2000s, whereas in the 1990s they were spread across most of the country.

This clustering seems to be a result of air-pressure anomalies and shifting jet streams over Eurasia in autumn and winter since the late 1990s. These changes can

cause cold Siberian air to flow into and persist over northern China, the team found.

J. Geophys. Res. <http://doi.org/q5k> (2014)

METABOLISM

Mother's fatty diet hurts offspring

Female mice that eat a high-fat diet while nursing their pups predispose them to obesity and diabetes by altering the pups' brain wiring.

Tamas Horvath at Yale University in New Haven, Connecticut; Jens Brüning at the Max Planck Institute for Neurological Research in Cologne, Germany; and their team discovered that mice that

ate a fatty diet during lactation had pups that were fatter, had higher insulin levels and were less sensitive to insulin than the offspring of mothers that ate a normal diet. In the fat pups, fewer fibres from specific neurons branched into regions of the brain's hypothalamus that regulate energy metabolism.

This circuitry is established in mice shortly after birth, but in humans it develops during the last trimester of pregnancy. The authors suggest that a mother's diet during this period could have long-term health effects for the child.

Cell <http://doi.org/q7k> (2014)

ENGINEERING

Phone device detects mercury

A smartphone attachment can detect low levels of mercury in water samples, opening the door to on-site, low-cost environmental monitoring.

Inorganic mercury is harmful to the kidneys, and can be converted by bacteria into its neurotoxic, organic forms. The device (pictured), developed by Aydogan Ozcan and his colleagues at the University of California, Los Angeles, can measure inorganic mercury at levels of 3.5 parts per billion (p.p.b.) — good enough to detect the maximum acceptable level of 6 p.p.b. advised by the World Health Organization. The attachment shines green and red light through tiny test tubes, which contain the water sample and a few reagents. The mobile phone's camera detects the light, which shifts towards green wavelengths if mercury is present. A



custom-made app provides the measurement.

The researchers tested their device by creating a mercury-contamination map of 50 locations in California.

ACS Nano <http://doi.org/q6n> (2014)

IMMUNOLOGY

Poor diet boosts innate immunity

Vitamin A deficiency enhances the immune system's response to parasitic worm infections in mice.

Malnutrition typically impairs the body's ability to fight infection. But Yasmine Belkaid at the US National Institutes of Health in Bethesda, Maryland, and her team found that depriving mice of vitamin A boosts an arm of the immune system that protects the body's barriers, such as the gut. Animals lacking this vitamin had a much higher level of ILC2 cells — immune cells that are active in barrier defence — in the gut than mice on a normal diet, and were better able to fend off infection by a nematode worm.

Vitamin A deficiency is common in areas where worm infection is also prevalent. The findings suggest a way that the immune system has adapted to promote survival even in the face of malnutrition.

Science 343, 432–437 (2014)

PUBLIC HEALTH

Mutations toughen up tuberculosis

A genomic analysis of the tuberculosis bacterium in a Russian population reveals that the microbe is not only evolving resistance to multiple drugs, but also retaining its ability to survive and spread.

Francis Drobniowski at Queen Mary University of London and his colleagues sequenced the genomes of 1,000 *Mycobacterium tuberculosis* isolates from people in western Russia.

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GENOMICS

Dogs domesticated before farming

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Dogs became companions for humans long before the advent of agriculture, according to a genome-sequencing study.

A team led by Robert Wayne at the University of California, Los Angeles, and John Novembre now at the University of Chicago, Illinois, analysed the genomes of three wolves (*Canis lupus*) from regions where dogs are thought to have first been domesticated. The authors also studied the genomes of two dog breeds, including Australian dingoes (pictured), and of a golden jackal.



The researchers determined that dogs were probably domesticated from now-extinct wolves between 11,000 and 16,000 years ago — before humans began farming around 10,000 years ago.

The findings contradict a previous genome study, which argued that dog domestication was associated with farming.

PLOS Genetics 10, e1004016 (2014)

Two-thirds of the isolates belonged to a lineage that first emerged in Asia and is prone to developing drug resistance. More than 60% of the isolates had drug-resistance mutations. Such mutations typically hinder bacteria's ability to spread, but the team found new 'compensatory' mutations that might maintain transmissibility in more than 400 isolates with resistance to the antibiotic rifampicin.

The findings suggest that biological factors, and not just weak public-health measures, are behind the high incidence of tuberculosis in Russia.

Nature Genetics <http://dx.doi.org/10.1038/ng.2878> (2014)

PHOTOVOLTAICS

Hot solar cells make more power

A photovoltaic device that converts sunlight into heat to generate power has achieved greater efficiency than previous such devices, thanks to the design of nanomaterials in the

light-absorbing layer.

Thermophotovoltaics contain a layer that absorbs a wider spectrum of wavelengths than conventional solar cells. This layer radiates heat that is used to generate electricity. Evelyn Wang and her team at the Massachusetts Institute of Technology in Cambridge designed their absorber-emitter material by growing an array of carbon nanotubes, which turn light into heat, onto a layer of photonic crystals, which they engineered to emit energy of the optimum levels for power generation.

The researchers' device reached an energy conversion efficiency of 3.2%, three times greater than in previous experiments. The authors say that with further improvements, efficiency could exceed 20%.

Nature Nanotech. <http://doi.org/q6j> (2014)

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